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On May 8th.—1623 to 1635.—C. Cochrane and E. A. Cowper. Regenerative hot-blast stoves for heating air, steam, and other gases.—O. Sweeney. Apparatus for burning petroleum and other volatile oils and spirits.—W. Bull. Hand dredger for sinking wells in foundations of bridges, and for other similar useful purposes. D. Nicoll. Vessels for containing aërated and other liquids.—J. J. Mitchell. Machinery for hoeing turnips.—E. P. H. Vaughan. Manufacture of metallic compositions, having phosphorus combined therewith, the same being applicable for bearings and other parts of machinery exposed to friction (com.) (Complete specification).—E. Kaulbach. Apparatus for raising and lowering gaseliers and chandeliers, the same being applicable also for other purposes.—H. Searle. Wrappers or envelopes used in oilcake making, and for extracting oil from oleaginous seeds.—J. M. B. Baker. Appliance to be adapted to railway carriage and other doors to prevent noise from slamming. —G. Haseltine. Machinery for ornamenting and finishing buttons and other like articles (com.) (Complete specification).—D. M. C. Smyth. Feed-motions for sewing machines.—A. M. Clark. Method of retouching photographic negatives and positives (com.)—G. W. Elliott. Sewing machines.

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(Continued on page 132.)

THE BRITISH ASSOCIATION.

THE forty-fourth annual meeting of the British Association commenced on August 19th, at Belfast, under its president, Professor Tyndall, F.R.S. Many of its leading members attended upon the occasion, including Sir John Lubbock, Bart., M.P., Professor Odling, Professor Huxley, Professor Hull; whilst there were also present the Earl of Enniskillen, the Earl of Rosse, Sir R. Wallace, the Rev. Dr. Henry, President of the Queen's College, Belfast; the Provost of Trinity College, Dublin; Professor Stokes, together with other gentlemen distinguished in science and literature. The place selected for the meeting was the Queen's College, situated in one of the most beautiful suburbs of Belfast, within easy access to the city.

Professor **TYNDALL**, F.R.S., commenced by tracing the scientific knowledge of natural phenomena from its development in the earliest times known to us—beginning with its anthropomorphic form to that period when it was placed upon a worthy basis, viz., when the doctrine of atoms, molecules, and Democritus was reached. He then followed this doctrine through the labours of the prominent figures connected with its introduction, remarking, as regards Epicurus, that his philosophy was almost identical with that of Democritus, but he never quoted either friend or foe. One main object of Epicurus was to free the world from superstition and the fear of death. Death he treated with indifference. It merely robs us of sensation. As long as we are, death is not; and when death is, we are not. Life has no more evil for him who has made up his mind that it is no evil not to live. He adored the gods, but not in the ordinary fashion. The idea of divine power properly purified, he thought, an elevating one, still he taught "Not he is godless who rejects the gods of the crowd, but rather he who accepts them." The gods were to him eternal and immortal beings, whose blessedness excluded every thought of care or of occupation of any kind. Nature pursues her course in accordance with everlasting laws, the gods never interfering. They haunt—

"The lucid interspace of world and world
Where never creeps a cloud or moves a wind,
Nor ever falls the least white star of snow,
Nor ever lowest roll of thunder moans,
Nor sound of human sorrow mounts to mar
Their sacred everlasting calm."

Lange considers the relation of Epicurus to the gods "subjective"—the indication, probably, of an ethical requirement of his own nature. Referring to the check scientific inquiry received during the middle ages, and the revival of it among the Moors of Spain, with the work subsequently carried on by Copernicus, Giordano Bruno, Kepler, and Newton, and pursuing the history of the doctrine of atoms, the Professor stated that it slumbered until the 17th century, when it was promulgated again by Père Gassendi, a bold ecclesiastic, who contrived, without incurring the censure of the Church or the world, to outstrip Mr. Darwin. The atomic doctrine, in whole or in part, was entertained by Bacon, Descartes, Hobbes, Locke, Newton, Boyle, and their successors, until the chemical law of multiple properties enabled Dalton to confer upon it an entirely new significance. What these atoms, self-moved and self-posited, can and cannot accomplish in relation to life, is at the present moment the subject of profound scientific thought. Professor Tyndall then made mention of Bishop Butler, and the views entertained by him in his celebrated "Analogy of Religion," contrasting them with those advocated by Lucretius, by introducing an imaginary argument between the Bishop and a Lucretian disciple, the Professor's audience being supposed to be the umpire of the contest. The vast additions to scientific thought since Bishop Butler's time were then commented on, and the astounding revelations of geology referred to. This led the Professor up to a consideration of the theories propounded by Mr. Darwin in the "Origin of Species" and "Natural Selection," and expounded with such clearness by Mr. Huxley, who was described as having swept the curve of discussion through the really significant points of the subject, enriching his exposition with profound original remarks and reflections, often summing up in a single pithy sentence an argument which a less compact mind would have spread over pages. In our day great generalisations have been reached, and the theory of the origin of species is but one of them. Another is the doctrine of the conservation of energy, that doctrine exacting from every antecedent its equivalent consequent, from every consequent its equivalent antecedent, and laying vital as well as physical phenomena under that law of casual connection which may be said to assert itself everywhere in nature. Long ago the constancy and indestructability of matter had been affirmed, and the latter quality was later extended to force. The idea applied to inorganic thus embraced organic nature. The vegetable world was proved incompetent to generate anew either matter or force, and the animal equally uncreative. The activity of each animal was shown to be the transferred activities of its molecules—the muscles' stores of mechanical force, potential until unlocked by the nerves, and the speed at which messages fly along these to and fro less than that of an eagle on the wing. This was the work of the physicist; then came the conquests of the comparative anatomist and physiologist, revealing the structure of every animal, and the function of every organ in the whole biological series, from the lowest zoophyte up to man. The nervous system had been made the object of profound and continued study, the wonderful power which it exercises over the whole organism, physical and mental, being recognised more and more. Thought could not be kept back from a subject so profoundly suggestive. Besides the physical life dealt with by Mr. Darwin, there is a physical life presenting similar gradation, and asking equally for a solution. With the mass of materials furnished by the physicist and physiologist in his hands, Mr. Herbert Spencer, twenty years ago, sought to graft upon this basis a system of psychology, and, two years ago, a second and greatly amplified edition of his work appeared. Mr. Spencer's fundamental principle is, that between the creature and the medium in which it lives there is incessant interaction. The organism is played upon by the environment, and is modified to meet the requirements of the environment. Life he defines to be "a continuous adjustment of internal relations to external relations." In the lowest organisms we have a kind of tactual sense diffused over the entire body; then, through impressions from without and their corresponding adjustments, special portions of the surface become more responsive to stimuli than others. With the development of the senses the adjustments between the organism and its environment gradually extend in space, in time, in speciality and complexity, passing through the various grades of brute life and prolonging themselves into the domain of reason. Very striking are Mr. Spencer's remarks regarding the influence of the sense of touch upon the development of intelligence. This is, so to say, the mother-tongue of all the senses, into which they must be translated to be of service to the organism. Hence its importance. It is a fact of supreme importance that actions the performance of which at first requires even painful effort and deliberation may by habit be rendered automatic; and, combined with the doctrine of hereditary transmission, we reach a theory of instinct. A chick, after coming out of the egg, balances itself correctly, runs about, picks up food, thus showing that it possesses a power directing its movements to definite ends. In its inherited organisation are registered all the powers which it displays at birth. So also as regards the instinct of the hive-bee; and man carries with him the physical texture of his ancestry, as well as the inherited intellect bound up with it. By myriad blows (to use a Lucretian phrase) the image and superscription of the external world are stamped as states of consciousness upon the organism, the depth of the impression depending upon the number of the blows. When two or more phenomena occur in the environment invariably together, they are stamped to the same depth or to the same relief, and indissolubly connected. "If there exist certain external relations which are experienced by all organisms at all instants of their waking lives—relations which are absolutely constant and universal—there will be established answering internal relations that are absolutely constant and universal. Such relations we have in those of space and time. As the substratum of all other relations of the non-ego, they must be responded to by conceptions that are the substrata of all other relations in the ego. Being the constant and infinitely repeated elements of thought, they must become the automatic elements of thought—the elements of thought which it is impossible to get rid of—the 'forms of intuition.'" Throughout this application and extension of the "Law of Inseparable Association," Mr. Spencer stands on totally different ground from Mr. John Stuart Mill, invoking the registered experiences of the race instead of the experiences of the individual. His overthrow of Mr. Mill's restriction of experience is, I think, complete. The learned Professor then went on to say as follows:—The origination of life is a point lightly touched upon, if at all, by Mr. Darwin and Mr. Spencer. Diminishing gradually the number of progenitors, Mr. Darwin comes at length to one "primordial form," but he does not say, as far as I remember, how he supposes this form to have been introduced. He quotes with satisfaction the words of a celebrated author and divine, who had "gradually learnt to see that it is just as noble a conception of the Deity to believe He created a few original forms, capable of self-development into other and needful forms, as to believe that He required a fresh act of creation to supply the voids caused by the action of His laws." What Mr. Darwin thinks of this view of the introduction of life I do not know. Whether he does or does not introduce his "primordial form" by a creative act I do not know. But the question will inevitably be asked, "How came the form there?" With regard to the diminution of the number of created forms, one does not see that much advantage is gained by it. The anthropomorphism, which it seemed the object of Mr. Darwin to set aside, is as firmly associated with the creation of a few forms as with the creation of a multitude. We need clearness and thoroughness here. Two courses, and two only are possible. Either let us open our doors freely to the conception of creative acts, or, abandoning them, let us radically change our notions of matter. If we look at matter as pictured by Democritus, and as defined for generations in our scientific text-books, the absolute impossibility of any form of life coming out of it would be sufficient to render any other hypothesis preferable; but the definitions of matter given in our text-books were intended to cover its purely physical and mechanical properties. And, taught as we have been to regard these definitions as complete, we naturally and rightly reject the monstrous notion that out of such matter any form of life could possibly arise. But are the definitions complete? Everything depends on the answer to be given to this question. Trace the line of life backwards, and see it approaching more and more to what we call the purely physical condition. We reach at length those organisms which I have compared to drops of oil suspended in a mixture of alcohol and water. We reach the *protogenes* of Haeckel, in which we have "a type distinguishable from a fragment of albumen only by its finely granular character." Can we pause here? We break a magnet and find two poles in each of its fragments. We continue the process of breaking; but, however small the parts, each carries with it, though enfeebled, the polarity of the whole. And when we can break no longer, we prolong the intellectual vision to the polar molecules. Are we not urged to do something similar in the case of life? Is there not a temptation to close to some extent with Lucretius when he affirms that "nature is seen to do all things spontaneously of herself without the meddling of the gods?" or with Bruno, when he declares that matter is not "that mere empty capacity which philosophers have pictured her to be, but the universal mother who brings forth all things as the fruit of her own womb?" The questions here raised are inevitable. They are approaching us with accelerated speed; and it is not a matter of indifference whether they are introduced with reverence or irreverence. Abandoning all disguise, the confession that I feel bound to make before you is that I prolong the vision backward across the boundary of the experimental evidence, and discern in that matter, which we in our ignorance—and notwithstanding our professed reverence for its Creator—have hitherto covered with opprobrium, the promise and potency of every form and quality of life. Professor Tyndall then proceeded to state that with Mr. Spencer, as with the uneducated man, there is no doubt or question as to the existence of an external world. But he differs from the uneducated, who think that the world really is what consciousness represents it to be. Our states of consciousness are mere symbols of an outside entity which produces them and determines the order of their succession, but the real nature of which we can never know. The whole process of evolution is the manifestation of a power absolutely inscrutable to the intellect of man. The strength of the doctrine of evolution consists, not in an experimental demonstration (for the subject is hardly accessible to this mode of proof), but in its general harmony with the method of nature as hitherto known. Further, the doctrine of evolution derives man, in his totality, from the interaction of organism and environment through countless ages past. The human understanding, for example—that faculty which Mr. Spencer has turned so skilfully round upon its own antecedents—is itself a result of the play between organism and environment through cosmic ranges of time. It is a result of the play of organism and environment that sugar is sweet and that aloes are bitter, that the smell of henbane differs from the perfume of a rose. There are such things woven into the texture of man as the feeling of awe, reverence, wonder, and the love of the beautiful, physical and moral, in nature, poetry, and art. There is also that deep-set feeling which, since the earliest dawn of history, and probably for ages prior to all history, incorporated itself in the religions of the world. You who have escaped from these religions into the high and dry light of the understanding may deride them; but in so doing you deride accidents of form merely, and fail to touch the immovable basis of the religious sentiment in the emotional nature of man. To yield this sentiment reasonable satisfaction is the problem of problems at the present hour. And grotesque in relation to scientific culture as many of the religions of the world have been and are—dangerous, nay, destructive, to the dearest privileges of freemen as some of them undoubtedly have been, and would, if they could, be again—it will be wise to recognise them as the forms of a force, mischievous, if permitted to intrude on the region of knowledge, over which it holds no command, but capable of being guided by liberal thought to noble issues in the region of emotion, which is its proper sphere. It is vain to oppose this force with a view to its extirpation. What we should oppose, to the death if necessary, is every attempt to found upon this elemental bias of man's nature a system which should exercise despotic sway over his intellect. The impregnable position of science may be described in a few words. All religious theories, schemes, and systems, which embrace notions of cosmogony, or which otherwise reach into its domain, must, in so far as they do this, submit to the control of science, and relinquish all thought of controlling it. Acting otherwise proved disastrous in the past, and it is simply fatuous to-day. It has been said that science divorces itself from literature; the statement, like so many others, arises from lack of knowledge. A glance at the less technical writings of its leaders—of its Helmholz, its Huxley, and its Du Bois-Reymond—would show what breadth of literary culture they command. Science desires isolation, but freely combines with every effort towards the bettering of man's estate. I have touched on debatable questions, and led you over dangerous ground—and this partly with the view of telling you, and through you the world, that as regards these questions science claims unrestricted right of search. It is not to the point to say that the views of Lucretius and Bruno, of Darwin and Spencer, may be wrong. I concede the possibility, deeming it indeed certain that these views will undergo modification. But the point is, that, whether right or wrong, we claim the freedom to discuss them. The ground which they cover is scientific ground; and the right claimed is one made good through tribulation and anguish, inflicted and endured in darker times than ours, but resulting in the immortal victories which science has won for the human race. I would set forth equally the inexorable advance of man's understanding in the path of knowledge, and unquenchable claims of his emotional nature which the understanding can never satisfy. The world embraces not only a Newton, but a Shakespeare; not only a Boyle, but a Raphael; not only a Kant, but a Beethoven; not only a Darwin, but a Carlyle. Not in each of these, but in all, is human nature whole. They are not opposed, but supplementary; not mutually exclusive, but reconcilable. And if, still unsatisfied, the human mind, with the yearning of a pilgrim for his distant home, will turn to the mystery from which it has emerged, seeking so to fashion it as to give unity to thought and faith, so long as this is done not only without intolerance or bigotry of any kind, but with the enlightened recognition that ultimate fixity of conception is here unattainable, and that each succeeding age must be held free to fashion the mystery in accordance with its own needs, then, in opposition to all the restrictions of Materialism, I would affirm this to be a field for the noblest exercise of what, in contrast with the knowing faculties, may be called the creative faculties of man. Here, however, I must quit a theme too great for me to handle, but which will be handled by the loftiest minds ages after you and I, like streaks of morning cloud, shall have melted into the infinite azure of the past.

The learned professor resumed his seat amidst loud cheers. During the delivery of the address he was frequently interrupted by applause. A vote of thanks, on the motion of the Mayor of Belfast, was carried unanimously.

AUGUST 20.

SECTION A. — MATHEMATICAL AND PHYSICAL SCIENCE.

The Rev. Professor J. H. Jellett, M.A., M.R.I.A., President of the Section, presided. After some general observations, Professor Jellett went on to state that he would confine attention to the inquiry, What indications on this subject are presented by the actual progress of physical science? Does its history exhibit a tendency to widen or contract the field of mathematical analysis? Passing over sciences like astronomy, which, though not wholly free from hypothesis, do not give us very extended information on this point, he said, I come to a part of scientific history to which we may put the question with every probability of obtaining (so far, at least, as one science is concerned) a decisive answer—I mean, the history of physical optics. We have here a science whose basis is purely hypothetical. The definition of light is an hypothesis, the nature of the æthereal motion is an hypothesis, even the very existence of the æther is an hypothesis—hypotheses, indeed, which have led to conclusions amply verified by experiment, but hypotheses still. Does the history of optical science indicate a desire to discard the hypothetical base? Commencing with Fresnel, more than half a century ago, the history of physical optics is a history of efforts, constantly repeated, to frame what M. de St. Venant has called "a really rational theory of light." The Professor passed to the consideration of another branch of science, closely connected with, and indeed including, physical optics, and exemplifying, even more strongly, the desire of scientific men to extend the sway of mathematics over physical science — by which he meant molecular mechanics; and, amongst other important remarks, said the logic of molecular dynamics may be shortly stated as follows:—In seeking to form the equations of motion of a body, solid or fluid, we commence by an imaginary division of the body into elements of any arbitrary magnitude, and we form the equations of motion for each of these elements considered as a unit. The results so obtained are true, but, as long as the elements retain a finite magnitude, incomplete. They do not give us full information as to the movement of the system. But suppose now, adopting the spirit of differential calculus, that the magnitude of these elements is constantly diminished; then it will be found that, as in the differential calculus, these equations tend towards a certain limiting form, constantly approaching it as the magnitude of the elements is continually diminished; and in this limiting form these equations are not only true but complete. Stated in this general form, the principles of molecular dynamics are not only perfectly logical, but wholly free from hypothesis. Molecular dynamics may be fairly called the differential calculus of physical science. Time will only allow me to notice very briefly another important application of mathematics to a branch of science considered hitherto to be altogether beyond the limits of our section. I refer to the application of the methods of geometry and theoretical mechanics in biological science recently made by Professor Haughton. The first example which I shall notice is the establishment of a principle governing the animal frame, and quite analagous to the principle of "least action" in dynamics. We have put to scientific history the important question—Is it probable that the dominion of mathematics over physical science will be more widely extended than it at present is? And to this question I think that scientific history must answer, Yes, it is probable. In concluding his speech the Professor said:—Another generation may learn to obliterate as completely the line between the domain of the chemist and the domain of the mathematician. When that shall be, when science shall have subjected all natural phenomena to the laws of theoretical mechanics, when she shall be able to predict the result of every combination as unerringly as Hamilton predicted conical refraction or Adams revealed to us the existence of Nepture—that we cannot say. That day may never come, and it is certainly far in the dim future. We may not anticipate it—we may not even call it possible. But not the less are we bound to look to that day, and to labour for it as the crowning triumph of science, when theoretical mechanics shall be recognised as the key to every physical enigma—the chart for every traveller through the dark infinite of Nature.

Dr. Huggins gave an account of some experiments he had made on Coggia's comet, which was so striking an object in the northern sky a few weeks ago, with the spectroscope.

Professor Curtis read a paper on "Extraordinary Reflection," and exhibited an apparatus for verifying his theoretical results.

Professor F. Guthrie next read his papers "On a New Class of Hydrates." In the course of his remarks, he said, by reducing the temperature of a saturated solution of a salt (in water), it is possible always to remove such an amount of any anhydrous salt (or hydrate rich in salt) that the residue solution acts as a whole, that is, crystallises at a constant temperature and of a constant composition. The temperature at which this uniformity of composition is attained appears to be lower according as the hydrate is richer in water. Professor Stokes suggested that as the proposition between the salt and the water at which the whole solidified was determined by physical considerations, the number of equivalents of water to one of the salt would probably be fractional or incommensurable, which would violate the usual conditions of crystallisation; but that these would be maintained if we supposed two different hydrates to crystallise out simultaneously.

Mr. P. Braham read a paper on "Further Experiments on Light with Circularly Ruled Plates of Glass."

Professor G. C. Foster offered suggestions for a re-determination of the absolute electro-magnetic units of resistance and electro-motive force. Professor Andrews described the methods of his experiments at high pressure, which gave rise to a discussion, in which part was taken by Professor James Thomson, Professor Maxwell, and Professor A. W. Williamson. The ex-President of the Association expressed his sense of the value of Dr. Andrews' experiments, and the importance to the chymical world that they should be continued. During this discussion the attendance at the Section largely increased.

Mr. J. Denear followed with a paper on a cognate subject—viz., "Latent Heat of Liquefied Gases."

A discussion also arose upon a paper by Professor Guthrie, "On the Flight of Birds, especially with reference to the Conditions of Atmosphere under which they can soar and hover." Professor Glaisher mentioned that, ascending in a balloon and taking with him a number of birds, he threw one out at a height of three miles, when it sank as if unable to float in the air, while at a height of four or five miles other birds which he tried to send out would not leave the balloon, but clung to him.

SECTION B.—CHEMICAL SCIENCE.

This Section met in the Chemistry Class-room, Queen's College. The President (Dr. A. Crum Brown) opened the proceedings by an address on chemical constitution. He first pointed out that the phlogistic controversy, which resulted from the discovery of oxygen, terminated in the total defeat of the phlogistists and the entire destruction of their theory. The issue of the next great chemical controversy, that between the dualistic theory of Berzelius and the substitution theory of Dumas, Laurent, and Gerhardt, was very different. Some historical writers argue as if here also the new doctrine had superseded the old; but the speaker maintained, as a more correct view of what really took place, that each theory underwent independent development, and inasmuch as both were sound, though imperfect, this development has now brought them very nearly to the same point. He illustrated this statement by an examination of the views of Berzelius as to the constitution of acetic and trichloracetic acid, and the constitution of ternary compounds, and showed how the difficulties involved in some of these cases were cleared up by the discovery of the multequivalent character of the atoms of certain elements. Dr. C. Brown defined chemical constitution as the order in which the constituents are united in the compound, and pointed out that the study of chemical changes (combination and decomposition) cannot lead us to a knowledge of the relative position of the atoms. But such a knowledge is required before a real theory of chemistry can be attained, and a knowledge of the intimate structure of matter may be looked for from an examination of the physical properties of substances and comparison of these with their chemical constitution. This, he maintained, is truly a branch of chemistry, and the greatest progress in it has been made by chemists, as may be proved by reference to the work of Faraday, of Graham, and of Andrews. By pursuing this branch, discoveries may be made which will lead to a hypothesis directly connecting chemistry with dynamics, and enabling us to apply mathematics directly to chemistry. The theory of chemistry will then be a particular case of the theory of dynamics. Such a result must be expected by all who believe in the progress of human knowledge, and in the consistency of Nature.

Professor G. C. Foster read a report of the committee on "Siemen's Electrical Pyrometer," which was composed of Professor A. W. Williamson, Professor Sir William Thompson, Professor Clarke Maxwell, and Professor Foster In this report the committee continued their former reports as to the degree of accuracy which could be attained by the use of this instrument. After a description of the instrument, the committee reported that it was found that changes of resistance amounting to ·001·0 h m. up to 10,000 of the quantity of heat to be measured could be detected without much difficulty. They then developed a mathematical formula for the connections to be applied in making observations with the instrument, and concluded by stating that a comparison of the results given proved that the repeated measurement of the same pyrometer without intermediate heating after gave almost identical results if they were made within a few days of each other, but that measurements made after an interval of a few months sometimes slightly differed from the results previously found, and they said that these changes were probably the result of alterations of the unsoldered connections of the conducting wires; but whatever their cause they were probably met with in actual practice if the pyrometers were used during long periods of time. Professor Dewar said, that as a chemist who had taken considerable interest in the determination by high temperature, and in getting at some satisfactory means of registration, he felt, and he was sure, all chemists engaged in physical chemistry would read with pleasure this reiteration of the information communicated last year by Professor Foster. (Applause.) By this they would overcome any difficulties that prevented them from determining specific heats at high temperature. Any other instrument than that mentioned in the address was extremely laborious, and to get satisfactory results took a much longer time. The President said they should certainly thank Professor Foster and the committee for the very laborious series of investigations they had made in this matter.

Professor Roscoe read the report of the committee for superintending the monthly reports on chemical progress.

Mr. W. Chandler Roberts read the joint report of Dr. Wright, Dr. Gladstone, and himself on the chemical and optical properties of essential oils.

Dr. Hodges read the report on chemical composition of jute fibre.

Dr. C. Brown delivered a lengthened and learned address on the subject of mithyle thetine.

On opium derivatives Dr. R. C. Wright next delivered an address.

SECTION C.—GEOLOGY.

President, Professor Edward Hull, M.A., F.R.S., F.G.S.

A matter of interest in this section arose out of the report of the Committee for the Utilization of Sewage. Professor Corfield read a report which stated that the Committee had been unable, from want of funds, to prosecute their inquiries as fully as they could have desired, but a member of the Association, feeling the importance of the subject, had promised the funds that were necessary to carry on the inquiry. Professor A. Williamson stated that the ground upon which the experiment was being conducted (Breton's Farm, near Romford) was originally composed of 60 per cent. of flint stones and 30 per cent. of sand, the remainder including traces of several kinds of soil. It had been proved that after three or four years of treatment with nitrogen the soil had become considerably enriched. It was arranged that the Committee should be reappointed.

A number of papers were read, most of which related to geological discoveries in Ireland.

Reports were also given in regarding cavern explorations. One of these was submitted by Mr. Pengelly, the Secretary of the Committee for exploring Kent's Cavern, Torquay. The report represented that the investigation had been pursued since the meeting of the Association in Bradford, and the work had been most satisfactorily performed. It was mentioned that live rats continued from time to time to present themselves in the cavern, and proved very troublesome during the summer season. Bees were also frequently seen in the innermost branches of the cavern, far beyond any glimpse of light. The report described minutely the researches which had been prosecuted, and the section thanked the Committee for their exertions.

Mr. R. H. Tiddeman read a report by the Committee for assisting in the exploration of the Setle Caves. The attention of the explorers during the year had been given chiefly to the Victoria Cave, in which were found among the boulders a few bones, a very large fragment of one of which appeared to be that of an elephant. In the Roman layer several bronze articles were discovered, and in other parts of the cave the explorers picked up many objects of interest, among them being glaciated stones. It was also mentioned that in 1872 a human bone was found at a depth of 20ft. from the surface of the lower cave earth, and about six yards from the boulders. In the course of a brief conversation which followed the reading of the report, Professor Harkness, Professor Geikie, and other members of the section expressed a desire that the investigation of the Committee should be continued, as they believed some interesting and important information was likely to be derived. The Committee were thanked for their work, and instructed to continue their explorations.

Professor A. Nicholson, M.D, D.Sc., F.R.S.E., Professor of Geology in the Royal College of Science, Dublin, read a paper on "A Remarkable Fragment of Silicified Wood," from the Rocky Mountains. He said the specimen which formed the subject of the present communication was brought by the late Mr. John Worthington, of Toronto, from the well-known "petrified forest" of Colorado. The petrified forest was a place familiar to, and much visited by, tourists. All round the area were placed numerous erect stumps of silicified trees, most of which were three or four feet in height, and from ten to twenty feet in diameter. These phenomena would strongly support the belief that those ancient trees grew upon the margin of a lake which has now disappeared. Professor Harkness said he was present at Brighton last year when this same specimen was exhibited. He was then under the impression that it was a piece of mineral rock, but, after hearing Mr. Nicholson's exhaustive paper, he had no hesitation in changing his opinion, and now believed it to be silicified wood. Rev. Dr. Macloskey, W. Pengelly, and the Chairman having made some observations, the thanks of the meeting were given to Professor Nicholson for his valuable communication.

Professor Nicholson also read four other papers on the following subjects:—Description of new species of *Cystiphyllum* from the devonian rocks of North America. Description of species of *Alecto* and *Hippothoa* from the lower silurian of Ohio, with a description of *Aulopera arachmoidea*. Description of new *Polyzoa* from the lower and upper silurian rocks of North America. On *Faristella stellata* and *Favistella calicina*, with notes on the affinities of *Favistella* and allied genera.

SECTION D.—BIOLOGY.

Professor Redfern, M.D., president of the Biological Section, delivered the opening address. The Section then separated into its three departments.

In the Anatomy and Physiology Department, the President, Professor Redfern, read a paper on "The Influence of Good Food and the Method of Supplying It to Plants and Animals." Of the latter part of the subject, he said there were few problems of more importance than how they should acquaint the wives of labourers, artisans, and even the wives and servants of the middle-classes, how they should expend a fair share of their income on food to the greatest advantage, and how to prepare it without destroying its nutritious properties. He condemned the practice of mincing or cutting up meat into small blocks and then stewing it, the effect of which was that the albumen in the outer face of each block became firmly set, and the whole afforded about as indigestible a mass as could well be imagined. The process of salting fresh meat had the effect, he said, of abstracting the juices and hardening the fibre so as to destroy or greatly deteriorate its digestibility. To a change of diet, the substitution of what were called the finer kinds of food for the buttermilk, oatmeal porridge, and bacon and beans formerly in use, his friend Dr. Gordon attributed the fact that the peasantry in the county of Down were not able to do the same amount of work as formerly, and that the athletic exercises in which they had formerly indulged had fallen into disuse.

In the Department of Anthropology, Sir George Campbell delivered an address on "The Peoples between India and China":—Among one of the tribes, he said, the wife was the head of the household. She courted and proposed to the man, and after marriage took the responsibility of providing for the family. She lived in her own house and on her own estate, and descent was on the female side. (Laughter.)

SECTION E.—GEOGRAPHY.

The Geographical Section met in the library of the Presbyterian College, under the presidency of Major Wilson, R.E.

In this Section the first paper read was one by Mr. E. G. Ravenstein, F.R G S., F.S G., giving a narrative of Dr. Nachtigall's explorations in Africa, 1869–74.

A cordial vote of thanks was awarded to Mr. Ravenstein.

The next paper to be taken up was one by Dr. S. Rowe, on "Sir John Glover's Expedition from the Volta to Coomassie." Major Wilson, president of the Section, introduced Dr. Rowe, who, he reminded the Section, was lately chief of the staff of Sir John Glover. Dr. Rowe then read his paper. Mr. Ball, after remarking that no one could fail to be satisfied with the great importance of Sir John Glover's expedition, adverted to the question of the duty of this country with reference to these African tribes. His own opinion was that a great country coming in contact with an uncivilized people had forced upon it duties from which it must not shrink if it would avoid the condemnation of posterity.

The President read extracts from a letter which he had received that evening from Colonel Gordon, who wrote from the River Lobat on the 26th of June. The communication showed that the writer was taking energetic steps to put an end to the slave trade in that region.

The other papers read in this Section were extracts from Lieutenant Cameron's journal with reference to the East African expedition, and a paper by Dr. G. Schweinfurth, on the oases of the Lybian Desert. Dr. Schweinfurt afterwards made a few remarks in German expressive of the pleasure which he experienced in visiting Britain, which was recognized as the home of exact geography and science, and in which earnest scientific inquiry had not been lessened by commercial prosperity. Votes of thanks were awarded the authors of papers. The Section then adjourned.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

The Right Hon. Lord O'Hagan, President.

The first paper read was by Sir George Campbell, K.G., on "The Privileges over Land, wrongly called Property," in which he remarked:—The divorce of the people from the land, which was daily rendered more complete by the enclosure of commons and the strict assertion of rights of property, must lead to revolution. The only way he saw to a popular tenure of land was the growth of tenant-right. On Conservative grounds that should be fostered.

After Sir G. Campbell had concluded his paper, Lord O'Hagan observed that the next paper to be read was on the Ulster Tenant Right by Professor Donnell. Professor Donnell proceeded to read his paper, which gave a minute and ample history and exposition of Tenant Right, and stated a variety of considerations which recommended it socially and economically.

Mr. D. Henderson also read a paper on the statistics of the Irish Land Act, showing that the Ulster Tenantry had got more than the tenantry of other Provinces, but what they had was more uncertain. There had been 768 cases connected with the operation of the Act in Ulster, while there had been only 660 cases tried throughout the rest of Ireland.

The other papers read were "Scheme of Technical Education for those Interested in Land," by the Rev. W. Western Wood; "Teaching of Hygiene in Government Schools" by Dr. R. Coton; "On the Adjustment of Punishment to the Causes of Crime," and "Postal Reform," by Mr. W. Hastings.

SECTION G.—MECHANICAL SCIENCE.

President, Professor James Thomson, F.R.S.E., who opened the proceedings by delivering his address. After mentioning that he had chosen to speak of those matters which, through their novely or their important progress in recent times would be most interesting, he proceeded to consider the various subjects of railway accidents, including the block system; deep sea soundings, signalling at sea, and house drainage.

A paper on "Water Power of the Upper Bann River," was read by Mr. John Smyth, jun., M.A., C.E.

Mr. George F. Deacon, C.E., read a paper descriptive of the Differentiative Waste Water Meter, one of which was exhibited in full operation. He said that the primary object of the waste water meter was to draw a diagram showing in gallons per hour the rate of flow through it for every instant during any day and night.

A paper on "Coal Mining in Italy" by Mr. P. Le Neve Foster, jun., C.E., was read by Mr Foster, sen. The writer dealt with the coal fields which were situated in the Tuscan Marenna, which, he said, appeared to have their origin in the middle Tertiary series.

Mr. William Bottomley read a paper describing the eclipsing apparatus at Holywood Lighthouses. The Belfast Harbour Commissioners, the author of the paper stated, had adopted the apparatus for the improvement of the light on the Holywood Bank. At present there was a red light fixed on the Bank, but it was liable to be mistaken for the red or port light of a vessel. The apparatus, which was designed by Sir William Thomson, and constructed by Mr. James White, Glasgow, for the Belfast Commissioners, was an improvement of the plan proposed by Charles Babbage, shown in the Exhibition of 1869. Sir William's proposal was that each lighthouse should exhibit from sunset to sunrise a definite series of eclipses, representing one of the letters known in telegraphy as the Morse alphabet; an experimental trial of the apparatus on the lighthouse had been made with very satisfactory results, and in a few weeks it would be in permanent operation. Mr. Bottomley believed that the success of the plan would direct public attention to this simple means of rectifying the defects in our present lighthouse system, and would lead to the adoption of it or some similar method for distinguishing lighthouses along the United Kingdom.

Two new species of fungi, from the neighbourhood of Kazan, in Russia, have been described by Herr N. Sorokin, in the "Botanische Zeitung." These organisms are of interest as representing new types, closely allied to Chytridiæ. The author proposes to include these types in a special natural group, to be described under the name of Siphomycetes.

DR. JOUSSET DE BELLESME has lately made a special study of the poison secreted by the scorpion, and has conducted a series of experiments showing its physiological action upon the blood. These experiments are recorded in an "Essai sur le Venin du Scorpion," published in the "Annales des Sciences Naturelles."

Reviews.

SULPHUR IN ICELAND.

"Sulphur in Iceland." By C. CARTER BLAKE, Doct. Sci., Hon. For. Sec. Lond. Anth. Soc. London: E. and F. N. Spon, 48, Charing-cross. 1874.

THIS is a work of advocacy, favouring the *exploitation*, as our French friends would say of the sulphur supplies to be obtained in a certain part of Iceland. It is a pleasantly-written pamphlet, and affords a good deal of interesting information on what is, without doubt, a subject of great industrial importance.

We select the following as an interesting sample of the work:—

The very language of Iceland seems to indicate the importance of its sulphur deposit. It is a significant fact that the Icelandic language indicates sulphur as the "burning stone" *brennisteinr*, unlike the Danish *svovel*, which is obviously derived from sulphur, Lat. So a sulphur mine is called *brennisteinrnàmar* in Icelandic, but in Danish *svovelgrubr*.

Mr. Vincent's theory, that sulphur is produced by the action of water on pyrites, though having some elements of probability in it, is nevertheless entirely unproven in the present state of science, and it is most unfortunate that throughout his paper theory and fact are mingled in equal proportions, each being independent of the other. "*Tant pis pour les faits*."

It was left for Captain Burton to point out that the testimony of Commander Commerell, which appears in Mr. Vincent's paper to make the transit from Krisuvik to Hafnarfjordr a real path of roses, did not actually speak with such unqualified enthusiasm. Commander Commerell says:—

"A tramway might also be laid down, but as there are two hills to cross with other difficulties, I could not positively state whether this were possible or not."

Another objection by Captain Burton appears to be of greater force. It is alleged that the Krisuvik deposits extend over an area of twenty-five miles. No precise geological map is given of the locality, and it is most significant that when Captain Burton and Mr. Chapman rode from Krisas Bay eastward to the Little Geyser, and although they looked anxiously for the enormous area theoretically assigned to the sulphur formation, they failed to see any sign of it. The sulphur, like the Spanish fleet, was not in sight, and the absence of the palagonite, which is invariably in other Icelandic localities found in juxtaposition with the sulphur, ought to hint to geologists the true state of the case.

Further on our author states:—These considerations, which have been so well urged by Captain Burton, are sufficient amply to demonstrate that there exists at Myvatn an enormous supply of sulphur for the use of the European colonist.

The Danish Government were not slow to perceive this, and have on numerous occasions endeavoured to attract attention to the value of their mineral products. Mr. Lock, an Englishman, some years ago petitioned the Danish Government, and expressed his wish to take a lease of the sulphur mines at Myvatn. A committee was elected by the Icelandic Althing to report upon this subject. This report, which is dated the 14th August, 1869, exhibits the utmost timidity in permitting an alien to acquire rights over the mineral products of Iceland.

It is argued:—

"That the inhabitants will not be able to benefit by this if the mines are made over to strangers, neither can it be controlled that they should not destroy the mines altogether, and render them completely useless, after a lapse of some years.

"The sulphur mining at Krisuvik has shown that these mines are better and richer than had been expected, and this may be the case, too, with the mines on the north, which have most frequently been deemed richer and more extensive than those of Krisuvik."

HOMŒOPATHY.

"The Influence of Homœopathy on General Medicine since the death of Hahnemann." By R. E. DUDGEON, M.D., Edin. Being the Presidential Address delivered at the Congress of British Members of the Medical Profession practising Homœopathy, held in London, June 4th, 1874. London: Henry Turner, and Co., 77, Fleet-street, E.C., and 41, Piccadilly, Manchester. 1874.

As advocates of the progress of original ideas, we deem it right to bring this pamphlet under the notice of our readers; because we are aware that the journals of medical science are, as a rule, likely to take it up with an unfavourable bias, as relating to a system antagonistic to that which they hold to be othodox.

Whether homœopathy is all it claims to be or not, it is quite clear it is not a mere scheme of quackery, as the allopaths allege. Indeed, a main principle of homœopathy, namely, giving, for the cure of a disease, a medicine that has the power of producing a disease similar to the one to be cured;—in other words, a medicine that acts on the same parts or organs as the natural disease, appears to have been recommended in certain cases by Hippocrates, Asclepiades, Paracelsus, Stahl, and several others, though Hahnemann, the founder of homœopathy, was the first who insisted that it was the general rule for the application of drugs to disease; and he showed how remedies of this sort could be discovered, viz., by testing them in large doses on the healthy.

The review of the history of homœopathy commences by stating that up to the date of Hahnemann's death (1843)—31 years ago—it must be admitted that the effect of his doctrine and practice on the ordinary treatment of disease was inappreciable. The practice of medicine remained pretty much as it had been at the commencement of the present century. The abstraction of blood in acute inflammatory disorders by leeches, cupping and venesection was regarded by most orthodox practitioners not only as allowable but as indispensable. The depleting treatment attained its climax in the *coup sur coup* venesections of the illustrious but sanguinary Bouillaud. Purgation by the most drastic cathartics was regarded as the appropriate medication in almost every case. Mercurialization to the extent of salivation was still in vogue. Counter-irritation by blisters, rubefacients, issues, setons, and the actual cautery was in daily use. Sudorifics, diuretics, emetics, and so-called alterative treatment were universally employed.

If, now and then, the observation of a better result obtained by the followers of Hahnemann led a stray practitioner to express a doubt respecting the propriety of the ordinary depleting methods, his scepticism was resented by his orthodox colleagues, and the crass humoralism that prevailed was irreconcilable with a method which professed to cure without the evacuation of any of the fluids of the body.

The great and learned Hufeland could not deny that brilliant cures were effected by the mild specifics of homœopathy; but, while admitting so much, he deprecated the adoption of this method, exclaiming that if it should prevail it would prove "the grave of science." It might be supposed that that science was scarcely worth keeping above ground which failed to cure patients as well as its unscientific rival.

In this country the eminent surgeon, Mr. Kingdon, gave mortal offence by extolling the anti-inflammatory virtues of aconite, which had been taught him by a disciple of Hahnemann. He predicted that the time would soon come when aconite would supersede venesection, and "our lancets would be allowed to rust in their cases." An outcry was raised at this heretical vaticination, and the medical periodical which takes its name from the maligned instrument poured all the vials of its wrath on the head of the rash author, who was fain to recant his heresy in order to escape more serious consequences. Since then lancets have everywhere been rusting in their cases to the unspeakable advantage of the patient-world.

The favourable, though limited, testimony to the success of homœopathic treatment given, with all candour, by the most eminent of modern surgeons, Mr. Liston, fell upon unwilling ears. Liston was too great a man to be bullied, and too courageous and independent to be made to retract a well-considered opinion, so he was let alone, and his testimony in favour of homœopathy quietly ignored.

So, in spite of the occasional protest of some distinguished member of the dominant school, the practice of that school remained uninfluenced by Hahnemann's teaching up to the time of his death. Every description of heroic practice (which, being interpreted, means violent interference with the normal processes) had its advocates. The most perturbing methods were held by physicians to be—what they euphemistically termed—their "sheet-anchors" in various affections. Thus, in inflammatory diseases, bleeding was the sheet-anchor of one set, tartar-emetic the sheet-anchor of another, calomel the sheet-anchor of a third, purgatives, sudorifics, vesicants, diuretics, the sheet-anchors of as many other sets. Other diseases had an equal or greater number of sheet-anchors. How such destructive processes ever came to be called "sheet-anchors" it would be hard to tell; or why "anchors" at all—"torpedoes" seems a more appropriate name for them, as they were designed to blow the disease to bits—but they just as often send the patient to the bottom.

After this general review of the history of the subject, Dr. Dudgeon dilates upon the hostility of the allopaths, examining boards, being, as he says, converted into inquisitorial Star-chambers, and their diplomas denied to candidates suspected of homœopathic leanings or who refused to promise never to practice homœopathy. Unworthy intrigues were set on foot to oust Henderson from his chairs of clinical medicine and pathology. Distinguished physicians were summarily expelled from hospitals they had served with honour and success, because they sought to give their patients the benefit of homœopathic treatment. Laws were passed by colleges and societies denouncing all who prescribed medicines according to the principle of similars as unworthy of association with those who prescribed differently. A medical Bill was introduced into Parliament, one main object of which was to put down what was called "irregular practice"—meaning thereby homœopathy. This object was fortunately frustrated by the vigilance of the practitioners aimed at, but the design was not the less apparent. Inquests held on the bodies of patients who had died under the care of homœopathic practitioners—for they would occasionally be so perverse—resulted in the finding by jurors under the direction of medical coroners of verdicts of "manslaughter;" at least, in one notorious case this verdict was, by the direction of Coroner Wakley, the brilliant editor of the trenchant *Lancet*, or rather, I should say, by that of his son and deputy, recorded against a practitioner whose own brother had died of Asiatic cholera while nominally under his care—but not really so—for, when the case took an unfavourable turn, the unfortunate practitioner was himself prostrated by an attack of cholera. It was, in truth, a glorious triumph of orthodox physic when the culprit was consigned to a cell in Newgate to await his trial for his life, nominally for killing his brother, but actually for his therapeutic heresies. To relieve the minds of those of you who do not remember the facts of the case, I may mention that on this occasion the majesty of "crowner's quest law" was not vindicated by the culprit's ignominious death on the scaffold, but that he was speedily released by a grand jury, which thus showed itself devoid of all proper feeling for the maintenance of orthodoxy in medicine.

But in spite, says Dr. Dudgeon, of denunciations, persecutions, caricatures, calumnies, *suppressiones veri, suggestiones falsi*, and coroners' inquests, the practice we owe to the genius of Hahnemann gained daily in public estimation. In medical matters the public looks only to results, and this test applied to homœopathic practice showed it to be, in numerous cases, vastly more successful than the ordinary treatment.

The growing confidence of the patient-world in homœopathy, together with the brilliant successes obtained by the practice among their own circle of acquaintances, as well as in public hospitals—more particularly the Homœopathic Hospitals of Vienna, which were visited and reported on by delegates from their own body—gradually forced upon the dominant school a reconsideration of their own methods of treatment.

The whole practice of medicine was changed with remarkable rapidity. The mildest drugs were alone employed. Treatment became at once "restorative" and "supporting." Diseases were all weaknesses requiring strengthening treatment. Tonics, nutritious food, and alcohol in every form, as wine, stout, ale, and brandy, were the fashionable medicines.

The complete change that took place in pathological ideas no doubt helped to produce this revolution in medical practice. The investigations of physiologists and pathologists completely discredited the gross humoral pathology by which alone the treatment of disease by evacuants could be justified. The general acceptance of the doctrine of the dynamical nature of disease gave the death-blow to all those monstrous forms of evacuant treatment which owed their origin to an antiquated materialistic pathology.

A sort of Œcumenical Council was held at the College of Physicians of Edinburgh, whose members issued a decree declaring that the medical faculty was now and had always been infallible and unchangeable, and that it was disease that had changed, not they. "Change of type of disease" was the shibboleth that was to reconcile the altered practice with the recognised infallibility of the faculty, that was to smooth all difficulties and efface all apparent inconsistencies.

This "change of type" notion was received with acclamation by medical writers and journalists, and at one time seemed on the point of being universally accepted as the true solution of the difficulty, and a ready method of accounting for the change of practice without admitting the influence of homœopathy in the matter.

The experience of Dietl in pneumonia, repeated as it was in many different quarters, and extended with like striking results to other inflammatory diseases, created an unduly favourable opinion of the expectant or do-nothing treatment of all diseases, and for a long time the leaders of medical opinion contended that all active medicinal treatment should be discarded, and that the sole duty of the physician should be to remove from the patient everything that was likely to interfere with the natural course of disease, to place him in the hygienic conditions most conductive to recovery, to attend to his diet and regimen, and to support his strength by generous food, and a more or less liberal use of alcoholic stimulants. In short, that the physician's chief duties should be a sort of combination of the offices of nurse and cook, and all medicinal interference was deprecated as being useless or even pernicious. In fact, medicine accurately corresponded to the sarcastic description of it given by Mephistophiles to the enquiring student, which we read in the first part of Goethe's *Faust*, and which I may freely paraphrase as follows:—

The secret of med'cine is: Nature's vast forces
You study in all their relations to man,
And when you have done this, your only right course is
To leave them to fight it out just as they can.

But it was impossible that such negative doctrines could obtain any wide-spread or permanent popularity among either the profession or the patient-world. The public naturally thought that the *raison d'être* of the physician was to cure, not merely to nurse disease. Medicines were justly held to be his curative instruments. The belief in the curative effects of medicines was too deeply implanted in men's minds to be annihilated in this fashion. Patients objected to having their diseases let alone. They had much faith in the remedial powers of drugs, and but little in those of nature, and they insisted on their doctors sharing their faith in physic. Some doctors who had lost their belief in medicines had acquired a firm persuasion of the remedial virtues of stimulants, and, under the leadership of the late Dr. Todd, a system of treatment by alcoholic preparations was carried on, the consequences of which were in many cases most deplorable.

But it would seem that the medical profession is undergoing an unacknowledged process of conversion to homœopathy, for Dr. Dudgeon continues:—The pathology of modern times has been gradually coming into accord with the homœopathic therapeutics. And this, I take it, is a remarkable and unique phenomenon in the history of medicine, that the therapeutics in consonance with a pathological theory should have preceded the theory. It would not be far from the truth to say that the therapeutics in this case was the cause of the pathological theory. At all events, it is hard to imagine that the rational pathology of our times would ever have been invented or adopted by a race of believers in the virtues of bleeding and other evacuant treatment.

Hahnemann saw that the pathological theories of his time would not square with his therapeutics, so he was forced to reject them and substitute more appropriate pathological theories of his own. But Hahnemann, though a good observer, was an indifferent theorist, and whilst his rule of treatment remains his pathological theories have, for the most part, fallen into oblivion.

Hufeland's prophecy has been fulfilled to a degree he little dreamt of, for homœopathy has proved "the grave of science"—of such science, pathological and therapeutical, as prevailed in his day, and could Hufeland see the state of medicine now-a-days, he would find the pathological theories and therapeutical methods he professed and practised all decently buried, and the master-spirits of medicine holding pathological views and pursuing pathological investigations in a way that must inevitably lead them, indeed, has already led them partially, to adopt therapeutical practices in the sense of the principle promulgated by the illustrious contributor of so many original articles to his *Journal*.

HISTORICAL EVIDENCE.

"The Rules of Evidence as Applicable to the Credibility of History." By WILLIAM FORSYTH, Q.C., LL.D., M.P. Being a Paper read before the Victoria Institute, or Philosophical Society of Great Britain, 2nd March, 1874. London: Robert Hardwicke, 192, Piccadilly; 1874.

THIS is a work well worthy of perusal, for in these days of almost universal scepticism it is truly a matter of importance, in many points of view, to be able to understand the grounds of one's belief in any matter which does not rest upon the evidence of our personal knowledge. No man is more competent to deal with this subject than Mr. Forsyth, and he has treated it with consummate ability; nevertheless, to our mind, he has, like most men, been unable to disburthen himself of views of what is true and right which have already become established in his mind. Lawyer like, Mr. Forsyth considers that whatever we do not see our way clear to disprove we are bound to believe. "For," says Mr. Forsyth, "to believe without any evidence at all is irrational; but to disbelieve against sufficient evidence is equally irrational. By sufficient evidence I mean such an amount of proof as satisfies an unprejudiced mind beyond all reasonable doubt. Mathematical truth alone admits of *demonstration*. All other kinds of truth can only be proved by probabilities, which vary in an almost infinite degree, from the faintest kind of presumption to what is called moral certainty, which is accepted as practically equivalent to demonstration.' Now, although we are quite prepared to admit that it is irrational to refuse to decide and act upon probabilities when only probabilities are to be got at, and when decision and action are absolutely requisite, yet we cannot see there is anything irrational in suspending the judgment as it is termed, in cases where no such necessity exists, especially if a case presented to us be made up of probabilities and improbabilities, the latter being perchance in greater quantity than the former, as are most histories, whether profane or sacred, especially when their authentication rests on hearsay upon hearsay, so to speak, or upon documentary evidence of old world doings, with no sufficient warranty as to the proper character of such documents, *i.e.*, whether they are copies of copies or original productions, though not the earlier original productions most people suppose them to be copies of. Of course, if we are prepared to take for granted enough to form a sufficient basis, it is not very difficult to believe the superstructure to be stable and trustworthy. Mr. Forsyth, like most of the advocates of orthodoxy, cannot fully understand that there is a state of mind in which, although we cannot say we believe, neither can we really say we disbelieve, and the intelligent investigator of history is usually in this frame of mind after considering all that can be said concerning its genuineness. When we find that a man can, in regard to circumstances occurring within one's own lifetime, create so much difficulty as the Claimant did in deciding whether he was the real Tichborne or only an Orton pretender, it is surely not irrational that after taking every pains to arrive at the truth of historical statements of very ancient date, we usually can do no more than pronounce them to be most probably true or very difficult to believe.

REVIEWS POSTPONED.

"The Royal Commission on Unseaworthy Ships, Examination of the Reports and Evidence of the Commission." By G. Howell.

"A Letter to the Duke of Somerset, Chairman of the Commission." By Samuel Plimsoll, M.P.

"Technical Training." By Thomas Twining, one of the Vice-Presidents of the Society of Arts. Macmillan and Co. 1874.

Mr. J. H. Foley, R.A., the eminent sculptor, died at his residence in London on Thursday, the 27th ult., in the 56th year of his age.

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THE INVENTORS' INSTITUTE,

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ESTABLISHED 1ST MAY, 1862.
President of Council:
SIR ANTONIO BRADY.

TO MEMBERS OF COUNCIL.

Council Meeting on Thursday, September 10th. Executive meeting at the same time.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts. F. W. CAMPIN, Sec.

Proceedings of the Institute.

ON the 6th August, 1874, a conference of the Executive (Committee) of the Institute with certain Members of Parliament (Messrs. A. Macdonald, T. Burt, Crawley, Charley, and Pennington being invited to attend) and Messrs. Broadhurst, Mottershead, G. Savage, T. Paterson, G. Howell, and others, as representing working men's interests, was held at 4, St. Martin's-place; SIR ANTONIO BRADY, President of the Council, in the Chair.

After the Secretary (Mr. F. W. Campin) had stated that the object of the meeting was to bring about a concurrence of views and co-operation of action with the Inventors' Institute on the part of members of Parliament and representative working men in regard to the amendment of the Patent Laws, which, as he explained by reference to correspondence with various members of the present Government, was likely to be taken in hand for the next Session of Parliament:—Sir Antonio Brady remarked that the object of the meeting, he need scarcely mention to those present, was of the highest importance to our national welfare, since success in industrial pursuits was the mainstay of this country; nor need he dwell upon the importance of a cheap and efficient Patent Law to members of the working classes, since all knew very well that many of our ingenious workmen were inventors, who complained loudly of the unjust operation of the existing Patent Laws, which practically forced the man of small means into the hands of capitalists or large employers of labour to be dealt with according to the pecuniary views of the latter.

Mr. G. SAVAGE quite concurred with Sir A. Brady in these remarks, and added that from his own knowledge he could say that the public lost the benefit of many good inventions because if a notion of improving any branch of industry entered a workman's brains he often took no trouble to work it out, upon the ground that he could get no adequate return for his ingenuity and trouble. And in some cases where working meninventors did work out their ideas in tangible models they frequently locked them up as secrets which were eventually buried in their graves.

Mr. MOTTERSHEAD quite agreed with all that had been said that evening, but he would remark that what was wanted was that the question of Patent Laws should be brought into activity as a question of the day; and if that were to be the basis of any movement he would heartily join in it. He thought cheapness in Patent Laws a *sine quâ non.*

Mr. CHARLEY, M.P., speaking as a member of the Legislature, could only remark that he came to the meeting to learn how he could be of service to the cause of Patent Law Amendment, and he would give his best attention to any propositions the Institute might lay before him.

[The other members of Parliament before mentioned made similar promises.]

After some observations by Mr. A. J. MURRAY, Mr. CARTTAR, Mr. M. M. HARRIS, and Mr. MORGAN, Sir ANTONIO BRADY moved, Mr. HARRIS seconded, and it was carried unanimously, that a joint Committee to act in this matter of those present be appointed.

At the Executive Meeting on 27th of August, a vote of condolence with the family of the late Sir W. Fairbairn, Bart., a Vice-President of the Inventors' Institute, was passed, and the Secretary was ordered to prepare and forward a suitable notification in writing thereof.

Monthly Notices.

Hygrometric qualities of woods have, by the researches of M. T. Du Moncel, found to be subject to variations corresponding with the variations in the humidity of the atmosphere at different times of the day, the maximum and minimum being a little before sunrise and a little before sunset respectively, even with woods which are to all appearance quite dry, and as electric conductivity has been found to have relation to humidity, these researches are worthy of note.

Dr. T. L. Phipson, with regard to sun sensitiveness of molybdate of ammonia dissolved in sulphuric acid, which forms a colourless solution, and is one of the best agents for determining the amount of chemical action in the sun's rays (this solution becoming blue by exposure to them, and becoming again colourless in the dark), repeats his recommendation made in the *Comptes Rendus* in 1863, of this solution in the *Chemical News*, as giving, he finds by renewed observations, more accurate results than any other.

Mr. James Lick, of San Francisco, has left to the State of California 700,000 dols., for the purpose of erecting and endowing an astronomical observatory, and furnishing it with "a powerful telescope, superior to, and more powerful than, any telescope ever yet made."

Detection of Poisonous Exhalation from Wall Papers.—Dr. Hamberg, of Stockholm, has been investigating the constituents of the atmosphere in rooms with walls covered with papers which contain arsenical pigments. The results of these researches are published in a recent number of the *Pharmaceutical Journal.* The paper of the room in which the experiments were conducted had a light green ground, with an ornamental pattern of brownish-yellow colour; this yellow was probably derived from an ochre, but the green resembled Schweinfurt green, and was strongly arsenical. An arrangement was made for drawing a current of air through a series of U-shaped and bulbed tubes, suspended on the wall. The passage of air was continued from July 16 to August 16, 1873; and it was calculated that during this time about 2,160,000 cubic centimetres of air had traversed the system of tubes. Some of the tubes had been plugged with cotton-wool, whilst others contained a solution of nitrate of silver, and at the termination of the experiment the contents of the tubes were separately examined. The results showed that there had been an arsenical exhalation. It is only fair to state that none of the family residing in the house suffered any marked injury to health, although Dr. Hamberg informs us that after sleeping in a room by the side of the department in which the experiments were made, and with the door open, he frequently experienced, on the following morning, a sense of heaviness in the head and a general feeling of weariness.

Death of M. le Comte Gustave Doulcet de Pontécoulant is announced, at his château, Pontécoulant (Calvados), on the 21st of July. His memoirs upon the great comet of Halley gave him a universal reputation. His mathematical papers led to his being named a Foreign Associate of our Royal Society and of the Royal Academy of Sciences of Belgium.

Paul Rosa.—We have also to announce the death, on the 11th of July, of this able assistant of Padre Secchi in the Astronomical Observatory of the Roman College. He has but just puplished, in the *Atti dell' Accademia Pontificia de' Nuovi Lincei,* a memoir, "Identité de la Période des Phénomènes Photosphériques et des Phénomènes Magnétiques en connexion avec la Mouvement Propre du Soleil."

Les Mondes for the 13th of August prints a good translation of Prof. Ramsay's "Physical History of the Rhine."

Oxidation of cinchonin, through the medium of nitric acid, has yielded to the researches of Dr. H. Weidel several new and peculiar derivatives. Four distinct acids have been prepared in this way, according to the strength of the nitric acid and the duration of its action on the alkaloid. These researches are described in the last number of the *Annalen der Chemie.*

Action of Alkalies and Oxodizing Agents upon Cotton Fibre.—According to M. Jeanmaire, if cotton upon being saturated with chromic acid, or chromate of potash and sulphuric acid, or with permanganate of potash, and subsequently washed, although the fibre presents no apparent change, it will be found to be seriously weakened when treated with an alkali. This cannot be too widely known by our calico-printers.

Ettringite, a mineral from Ettringen, near the Lake of Laach in the Eifel, has been described by Herr J. Lehmann as a new species. It is a hydrous sulphate of alumina and lime, to be so named. A new Mexican mineral, consisting of a double selenide of bismuth and zinc, has been described by Don A. del Castille.

Professor Grant has been removed by death during the past month.

M. Coggia, to whom we owe the first detection of the principal comet of this year, and who is acquiring a great reputation in this department of astronomy, discovered at Marseilles another new comet (which will reckon as V., 1874) on the 19th inst., in the constellation Taurus. At present it appears to be small and faint—even more so than the comet recently discovered by Borelly, and is only visible in powerful telescopes.

The rejection of a paper from Section D (British Association), entitled "An Irenicum, or a Plea for Peace and Co-operation between Science and Theology," by the Rev. Prof. Watts, D.D., of the Assembly's College, Belfast, caused some excitement. Bills were posted in the town, announcing that this rejected paper would be read in Elmwood Church; and a large and sympathetic congregation was thus drawn together. However praiseworthy the writer's intentions might be, it is clear that as there is no Section for Theology, the only course open to the Committee was to reject such a communication, though it may be questioned whether, under these circumstances, the President ought to make theological speeches.

The Pine-tree Odour.—The fine odour of recently-felled and barked pine-trees in spring time will be familiar to most. In *Berichte der Deutschen Chemischen Gessellschaft zu Berlin*, Ferd. Tiemann and W. Haarmann, in a paper "On Coniferin, and its Conversion into the Aromatic Principle of Vanilla," show that the juice scraped from the recent bark yields by digestion coniform which is at first inodorous, but which in the course of time acquires the odour of vanilla.

Uriah A. Boyden, of Boston, Mass., United States, has deposited with the Franklin Institute the sum of one thousand dollars, to be awarded as a premium to "any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

Mr. Charles J. Wister, in the *Journal of the Franklin Institute*, for July, has a paper "On the Moon's Figure as obtained in the Stereoscope," in which he shows that the oval or egg-shaped figure of the moon, as deduced from the calculations of the continental astronomer, Gussew, of Wilna, after stereoscopic examination, is an illusion connected with the principle of that instrument.

Researches in Acoustics, by Alfred M. Mayer, is a valuable contribution to the science of sound, which appears in the *American Journal of Science and Art* for August. In the same journal will be found two papers on analogous subjects, one by Prof. Ogden N. Rood, "On an Optical method of Studying the Vibrations of Solid Bodies," and "On the Phonautograph," by Mr. Charles A. Morey.

M. Alphonse de Candolle has just republished, from the *Archives des Sciences de la Bibliotheque Universelle de Genève*, in in which it appeared in May last, the "Constitution dans le Règne Végétal de Groupes Physiologiques applicables à la Géographie Botanique, Ancienne et Moderne."

An elliptic orbit of the fine comet discovered by Coggia on April 17 (III., 1874) has been calculated by Schulhof, of Vienna, with the result of a period of 12,184 years. Of course this can only be considered provisional, and the definite determination will not be made until the observations in the southern hemisphere are published; but it is at least certain that the orbit is extremely eccentric. This comet must not be confounded with the small comet (VII., 1873) re-discovered by the same astronomer on the 10th of last November, which has a period of about 55 years.

In Symon's Monthly Meteorological Magazine, for July, there are translations of two papers by MM. E. Belgrand and G. Lemoine and by Prof. Raulin, "On the Water Supply of France in the Summer and Autumn of 1874." The former express their belief that, in all probability, "the watercourses and springs of the Seine will fall, between now and the middle of next October, to almost the lowest point yet observed." The Professor informs us that the dearth of water during the last six months appears to have extended over the whole plain of South-West France and to the Pyrenees. Since rainfall observations were commenced in 1714, similar drought has only occurred six times, viz., in 1750, 1768, 1781, 1864, and 1874. He also states that there is reason for believing "that in the Eastern part of England the supply of water in wells, ponds, and streams will be very deficient, although not quite to the same extent as in North-Eastern France."

Mr. Spottiswoode has resigned the position of Treasurer of the British Association, and Prof. A. W. Williamson, of University College, London, has been appointed his successor.

French Physical Observatory.—The question of the establishment, near Paris, of a Physical Observatory, independent of the Astronomical one, came before the Académie des Sciences at the Séance of the 10th of August. The President of the National Assembly directed that the members of the Academy of Scienes should form a commission, which should examine into and report on the purposes and advantages of such an establishment.

Capt. Campello, of the Portuguese Navy, has been appointed to proceed to London to represent Portugal at the International Conference for Maritime Meteorology which is about to be opened. As is known, this Conference was first proposed at the International Conference of Brussels in 1853, and preliminary discussions took place at Leipzig in 1872, and at the Vienna Congress in 1873. Capt. Campello knows English, and has already visited London on a scientific mission; he has made astronomy and meteorology his special studies, and has been for many years attached to the *personnel* of the Lisbon observatories. The selection made by the Portuguese Government seems altogether a good one.

Elements and ephemerides of the comet (IV., 1874) discovered by Borelly on July 25 have now been published, both by Mr. Hind and by Dr. Holetschek, of Vienna, but much success cannot be expected in seeing so faint an object during the present increasing moonlight. It appears that it will be in perihelion on August 27, about 89 millions of miles from the Sun, or a little less than the Earth's mean distance It is now about 70 millions of miles from the Earth, increasing, and its apparent place in the constellation Draco.

Proceedings of Societies.

GEOGRAPHICAL SOCIETY.

JUNE 15TH.—General Sir H. Rawlinson, V.P., in the chair.—The following new Fellows were elected:—His Excellency Senhor Joao de Andrade Corvo, as Honorary Corresponding Member; Marquis of Lorne, Le Vicomte E. de S. St. Jéan, Major-General Bentinck, Lieut.-Col. J. G. R. Forlong, Rev. R. Lewis, Messrs. A. Brent, S. B. Coxon, R. Gordon, G. Grantham, W. H. Huddleston, H. J. Jenkinson, R. M. Lawes, A. Robertson, R. B. Smith, and J. M. Sutton. The papers read were:—"A Month's Journey in Kokand in 1873," by Mr. E. Schuyler; and "Progress of Forsyth's Mission to Kashgar and Exploration of the Pamir Steppe," by Major-General Sir H. C. Rawlinson.

ENTOMOLOGICAL SOCIETY.

JUNE 1ST.—Sir S. S. Saunders, President, in the chair. Mr. A. Guénee was elected an Honorary Member, in the place of M. Guérin-Méneville, deceased. Mr. A. O. Ward was elected a Subscriber. Mr. M'Lachlan exhibited specimens of the white ant (Calotermes, sp.), recently bred at Kew, from a sample of the wood of the tree (*Trachylobium Hornmannianum*) that produces the gum copal of Zanzibar. Mr. Stainton read a letter from the Rev. P. H. Newnham, stating that he had taken two living specimens of *Deiopeia pulchella*, on the Cornish side of the river Tamar. Mr. Stainton remarked on the early period of the year when they were captured as being very unusual. Mr. C. O. Waterhouse sent for exhibition a living specimen of a mantid (*Empusa pauperata*), in the lava or pupa state, brought from Hyères, by the Rev. Mr. Sandes. He had tried to feed it with flies, but could not induce it to eat anything while he was looking on. Mr. Stainton remarked that it would probably have seized a live spider at once if it had been offered one. Mr. W. D. Gooch communicated a detailed account of his experiences with regard to the longicorn coffee-borers of Natal. Dr. Horn (of Philadelphia) stated that European conifers, limes, &c., planted in a public park at Philadelphia, were all killed by the larvæ of native species, such as *Callidium antennatum* and *Monohammus dentator*, though apparently in a healthy condition, whilst the native trees were not perceptibly affected. He was inclined to believe that the insects attacked healthy trees; but Mr. M'Lachlan believed that, according to the observations of most European entomologists, the European species of longicorns did not attack living wood in a perfectly healthy state. Mr. Butler communicated a paper "On New Species and a New Genus of Diurnal Lepidoptera, in the Collection of Mr. Druce." Mr. Smith read a revision of the Hymenopterous genera Cleptes, Parnopes, Anthracias, Pyria, and Stilbum, with descriptions of new species of the genus Chrysis, from North China and Australia. The genus Anthracias was noticed as specially interesting, as it did not appear to have been recognised since Klug published his brief generic characters; but Mr. Smith had been able to recognise it from a specimen in the collection of the late Mr. Shuckard, where it had evidently been mistaken for an example of *Parnopes carnea*, which it closely resembled.

ZOOLOGICAL SOCIETY.

JUNE 16TH, 1874.—Dr. A. Günther, F.Z.S., V.P., in the chair. An extract was read from a letter received from Dr. A. B. Meyer, concerning two birds (*Rectes bennetti* and *Campephaga aurulenta*) lately described in the society's "Proceedings" by Mr. Sclater. A letter was read from Mr. W. Summerhayes, relating to certain species of curassows found in Venezuela. Dr. J. Murie read a paper on the nature of the sacs vomitted by the hornbills, which he stated, in confirmation of Professor Flower's account of these objects, to consist of the epithelial lining of the stomach. Mr. W. Saville Kent, F.L.S., F.Z.S., communicated a second paper upon the gigantic cephalopods recently encountered off Newfoundland. From further information received, Mr. Saville Kent apprehended that it would be necessary to refer the two individuals preserved in St. John's Museum to the genus *Ommatostrephes*, thus avoiding the institution of a new genus for their reception, as proposed in his former paper. Mr. A. H. Garrod read a paper on the "showing off" of the Australian bustard (*Eupodotis australis*) and pointed out the peculiar structures by which this "showing off" was accomplished. A communication was read from Dr. F. Stolicza, containing a description of the *Ovis polii* of Blyth, of which he had lately obtained specimens in Yarkand. Mr. R. Bowdier Sharpe read a paper on a new genus and species of Passerine birds from the West Indies, which he proposed to name *Phœnicomanes iora*. A communication was read from the Rev. O. P. Cambridge, containing descriptions of some new species of spiders of the genus *Erigone* from North America. Dr. Günther read a paper describing some new species of reptiles from the Camaroon Mountains, West Africa. Amongst these were two new species of chameleon, and a new snake of the family of Lycodontidæ, proposed to be called *Bothrolycus ater*. One of these chameleons was referred to a new subgenus (*Rhampholeon*) being remarkable for its abbreviated tail and the development of a denticle at the inner base of each claw. Mr. Sclater read a paper containing a description of three new species of the genus *Synallaxis* from M. Jelski's collections in Central Peru, which he proposed to call *S. pudibunda*, *S. graminicola* and *S. virgata*. Messrs. H. P. Blackmore and E. R. Alston communicated a joint paper on the Arvicolidæ which have hitherto been found in a fossil state. Professor Newton read an account of a living dodo shipped for England in the year 1628, extracted from letters in possession of Dr. J. B. Wilmot, of Tonbridge Wells. Mr. J. E. Harting read a paper on the common lapwing of Chili, which he proposed to separate from *Vanellus cayanensus*, under the name *V occidentalis*. A second paper read by Mr. Harting contained an account of the eggs of some new or little known Limicolæ. A communication was read from Mr. R. Swinhoe containing an account of a new cervine form discovered in the mountains near Ningpo, China, by Mr. A. Michie, and proposed to be called *Lophotragus michianus*. Dr. J. Murie read a paper on the structure of the skeleton of *Fregilupus varius*, based on a specimen in the Museum of Cambridge.

This meeting closed the present session. There will be no more scientific meetings until November next.

Communications intended for the scientific meetings of the Zoological Society of London, should be addressed to the secretary, P. L. Sclater, Esq., Hanover-square, London, W.

THE INSTITUTION OF CIVIL ENGINEERS.

The council of this society have just awarded the premiums and prizes, arising out of various trust funds, for papers read and discussed during the recent session. The several awards are as follows:—1. A Telford medal, and a Telford premium, to Bindon Blood Stoney, M.A., M. Inst. C.E., for his paper "On the Construction of Harbour and Marine Works with Artificial Blocks of Large Size." 2. A Telford medal, and a Telford premium, to Richard Christopher Rapier, Assoc. Inst. C.E., for his paper "On the Fixed Signals of Railways." 3. A Telford medal, and a Telford premium, to Joseph Prestwich, F.R.S., Assoc. Inst. C.E., for his paper "On the Geological Conditions affecting the Construction of a Tunnel between England and France." 4. A Watt medal, and a Telford premium, to Alexander Carnegie Kirk, Assoc. Inst. C.E., for his paper "On the Mechanical Production of Cold." 5. A Watt medal, and a Telford premium, to George Wightwick Rendel, M. Inst C.E., for his paper on "Gun Carriages and Mechanical Appliances for working Heavy Ordnance." 6. The Manby premium, to Leveson Francis Vernon-Harcourt, M.A., M. Inst. C.E., for his "Account of the Construction and Maintenance of the Harbour at Braye Bay, Alderney." 7. A Telford premium, to Major James Browne, R.E, Assoc. Inst. C.E., for his paper "On the Tracing and Construction of Roads in Mountainous Tropical Districts." 8. A Telford premium, to William Douglass, M. Inst. C.E., for his paper on "The Great Basses Lighthouse, Ceylon." 9. A Telford premium to Joseph McCarthy Meadows, for his paper on "Peat Fuel Machinery." The following prizes have likewise been awarded to students of the Institution:—1. A Miller prize to James Charles Inglis, Stud. Inst. C.E., for his paper on "Theory and Practice in the Construction of Tanks." 2. A Miller prize to Matthew Curry, jun, Stud. Inst. C.E., for his paper on "The Lisbon Steam Tramway." 3. A Miller prize to Walter Young Armstrong, Stud. Inst. C.E., for his paper "On the Construction of, and the means employed to place in Position, the Cylinders of a Bridge over the Wye, at Newport." 4. A Miller prize to Charles Graham Smith, Stud Inst. C.E., for his paper on "Practical Ironwork." 5. A Miller prize to Alfred Fyson, Stud. Inst. C.E., for his paper on "Details in the Construction of Docks." 6. A Miller prize to George Edward Page, Stud. Inst., C.E., for his paper on "Coal Gas and its Manufacture."

PATENT OFFICE REPORTS.

In their annual report for the year 1873, the Commissioners of Patents show that the number of applications for letters patent was 4,294, but that the number of patents passed was only 2,974; while 2,906 specifications were filed, and 1,320 lapsed or were forfeited, as the applicants had neglected to proceed for their patents within the six months of protection, and 68 were rendered void by the failure of the patentees to file specifications. Between October 1, 1852, and December 31, 1866, the number of 29,807 patents were applied for, but the additional progressive stamp duty of £50 was paid at the end of the third year on only 8,372 patents, while 21,435 became void. The additional progressive duty of £100 was paid at the end of the seventh year on 2,891 of those on which the £50 duty had been paid, and 5,481 were dropped. Thus 72 per cent. of the three years' patents were not proceeded with, and 90 per cent, of the seven years' patents also became void. All patents and specifications have, however, been printed and published in some form, either complete or abridged, and a method has been adopted for their due classification, and for rendering them easily accessible for reference. Liberal arrangements also appear to have been made for opening this collection of patents, &c., to the public, not only in London, but in the provinces, and also in the colonies, and many foreign countries, and a long list of towns, learned societies, &c., to which copies of patents have been supplied, is published. It appears from the balance-sheet that during 1873 the sum of £144,761 13s. 6d. was received for stamp duties under the Act, while the expenditure has left a surplus of £95,285 1s. 10d.

MORE SCHOOL BOARD DESPOTISM.

According to the police reports in the daily press, several persons were on Thursday, 27th August, fined by Mr. Barstow, the magistrate presiding at Worship-street Police-court, for not sending their children to a School Board school, although these children were sent to other schools. But as their high-mightinesses, the School Board officials, had not "*recognized*" these schools, whatever that may mean, the magistrate convicted these free-born Britons as evildoers requiring punishment, and lectured one of the parents for entertaining the improper view that girls ought not to be whipped, thus practically relegating the little girl back again to the tender mercies of the whipping governess.

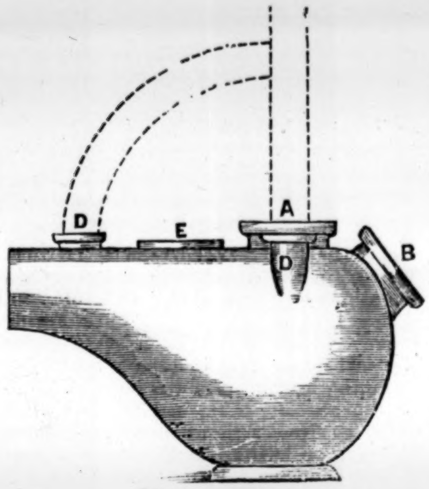
DEATH OF SIR WILLIAM FAIRBAIRN.

THIS eminent Manchester engineer died at ten minutes to one on the 18th ult., in the 86th year of his age, at Moor Park, Farnham, Surrey, where he had been staying during the past month, in the hope of benefiting his declining health. He was born at Kelso, in Roxburghshire, N.B., in 1798, and was educated at Newcastle-upon-Tyne, afterwards carrying on business at Manchester. During a long and useful life Sir William was constantly engaged in developing the capabilities of iron with reference to constructions of all kinds, and for a series of papers relating to this subject he received the medal of the Royal Society. He helped to establish the British Association for the Advancement of Science, and amongst his published works may be mentioned "Iron, its History and Manufacture," "Iron Shipping," and "Useful Information for Engineers." Sir William Fairbairn was deservedly created a Baronet of the United Kingdom in 1869, and he was besides a fellow of the Royal Society, a corresponding member of the National Institute of France of the Royal Academy of Turin, and a Chevalier of the Legion of Honour.

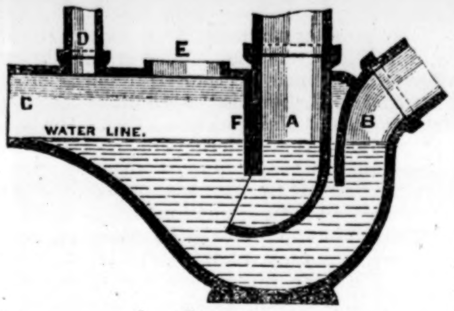
SEWAGE FARMING.

By invitation of the proprietor a party of about thirty gentlemen visited Mr. William Hope's farm of Bretons, near Romford, recently, for the purpose of observing the results of experiments which he has carried on for the last five years in the application of sewage to land. He has for many years been an active promoter of the utilisation of sewage, and has fought more than one severe battle in that cause by initiating and supporting Bills in Parliament with the object of dealing with the sewage of the metropolis. The farm of Bretons he had leased of the Romford Local Board of Health, and on this ground he has put his favourite scheme into operation, not with success. The property is about 120 acres in extent, and its soil is naturally very poor, having been worth originally only about £2 an acre; but by means of the process applied to it by Mr. Hope it has so greatly improved that it now bears really fine crops of several different kinds. That process is simple in the extreme. The sewage of Romford—or part of it, for Mr. Hope complains that he has not had the full benefit of the produce of the town—is conveyed to Bretons, two miles distant, through pipes. There it flows into reservoirs, and is pumped up to above the level of the surrounding fields, and reaches them by gravitation through open troughs and gutters. The sewage thus distributed undergoes no chemical or other manipulation whatever; the solid particles are deposited on the coarser land, and the rest flows in a liquid state exactly as it left the place of its origin. Some very fine crops of wheat, all spring sown, were seen; several fields of splendid mangold-wurzels have been produced; the cow-cabbage, all of which had been gathered, was, we were told, a remarkably good crop; and there was still on the ground the sixth cutting of rich Italian rye grass that had been grown during the year. Moreover, Mr. Hope has on his farm a stock of handsome and valuable cattle, whose good condition speaks well for the sewage-grown fodder on which they are fed.

McNEIL GREIG'S VENTILATING SEWER TRAP.



ELEVATION.



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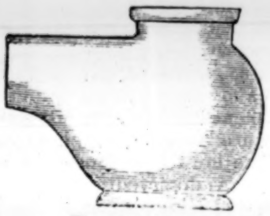

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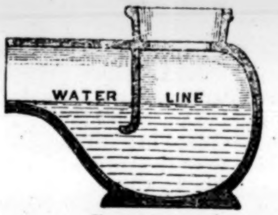

SECTION.

THIS appliance consists of a stoneware vessel, shaped like a bowl with a spout. Into this the soil-pipe is introduced by a socketed orifice, A, in the centre of the top, from which is continued a short pipe with its mouth below the water-line, turned in the same direction as that of the vessel. Thus matter falling with impetus down the soil-pipe is shot forward with violence sufficient to create a current powerful enough to clear out any sediment from within the bowl. At the back is an inlet-socket, B, to receive all the other discharge pipes from the same side of the house, such as sinks, areas, wastes, rain down-pipes, &c., the water from which would further tend to flush out the bowl and to keep it always charged with water, of which it holds about two gallons; C is the mouth or outlet delivery to the house-drain, D D are sockets for ventilating pipes, one of which serves to afford exit to all the gases generated in, or that find entrance into, the house-drain, and which naturally flow upward to this point, and the other for any that by any probability should pass the dipper of the trap, F. The two pipes, D D, will be united above and carried to a deodoriser or any safe high point of the building, as shall be hereafter discussed. E is a lidded hole for access to the interior of the bowl to enable the trap to be examined and cleaned when necessary, and F is the bridge or dipper of the trap.

Now all that is required is to place one of these appliances a short distance from the wall of the house at sufficient depth (say three feet) to prevent injury by frost, and to allow of the pipes being led to it in an easy bend; then to fit the soil-pipe into its socket at the top, and the several other pipes mentioned, by a junction branch at the back, and to dispose of the ventilating pipes in one or other fashion suggested, and the whole premises will be efficiently guarded from all chance of invasion by sewer gas, and all the waste-pipes will be properly severed, as has been recommended in the former articles. It will at once be noticed from the illustration how much larger a body of water is retained in the trap than is usually the case, and thus forming a powerful resistant.

Its form and material are such as to prevent corrosion, which, we think, is much to be feared when cast-iron is the material employed. There are no angles in it, but the curves are all such as to be throughly swept out continually by the current. The internal pipe (which is connected with the soil-pipe from above) conveys the discharge from closets well into the body of water beyond the bridge, towards the outlet to the drain, thereby preventing the return of fœcal offensive matter into the pipes or into the upper part of the trap beyond the bridge.

From careful experiments made it has been found that opaque refuse water and water containing a chemical of which the presence could be readily ascertained by tests, as well as floating bodies (wood, paper, &c.) passed down from a water-closet, were each rapidly displaced.

It remains to be seen by longer experience how far this appliance will sustain rough and long wear and tear. There seems no danger of the soil pipe becoming clogged by the careless introduction of any bulky articles that could pass through its diameter at the upper part, as they would be safely delivered far beyond the bridge into the house-drain, and in this respect the invention possesses all the freedom stated to be required at the foot of soil-pipes, just in fact as if there were no trap at all. The back inlet it would be as well to shield, for many reasons, from all chance of having bulky articles or grease carried down by the sink-pipe, and this might be done by placing below the sink a condensing and receiving chamber, whence by a grating only the fluid could pass to the trap. It would be found that thus a very large quantity of grease would be collected in such a reservoir that now is allowed to be wasted; and not only so, but to clog up drains and traps.

The inventor claims the following advantages in using this trap:—

1st. Its formation and material prevent corrosion.

2nd. It contains a much larger body of water than other traps hitherto offered to the public, thereby forming a powerful resistant against sewer gas entering house pipes.

3rd. The internal pipe (to which is connected the soil pipe from above) conveys the discharge from closets well into the body of water beyond the bridge to the outlet, thereby preventing the return of fœcal or offensive matter into the pipes, and into the upper part of the trap above the bridge.

4th. There is a second inlet, which is also trapped, to receive water from scullery sinks, areas and rain water pipes, which will cleanse the bottom of the trap.

5th. There are two ventilators in the crown, (one or both of which may be used) which relieve the trap from all offensive smells, by a distinct pipe conveyed therefrom to the top of each house.

6th. There is a man-hole provided to allow of inspection and cleansing, without disturbing the trap.

Correspondence.

PUBLIC ESTIMATION OF INVENTORS.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—I do not wonder that inventors get disheartened in this country. People say, I heard that was a new hobby of yours, and they annoy your family by addressing you as Patent A B C Maker. They use these A B C's themselves, and won't send a line to any one to say that they have done so. Our railway carriages are divided into six compartments, viz., first-class, second-class, and third-class, non-smoking, and smoking carriages for each class. In America you can go the whole length of the train, and show a drawing of an invention to several hundred people, but here you can, at most, show it to a dozen in a third-class perhaps. I find the Newcastle people the most intelligent I have met with, and would advise inventors to try that district. I went over to see the air-brake, but could not get sight of it.—I am, sir, your obedient servant,

C. BUTLER CLOUGH.

Chester, July 28th, 1874.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 122.)

rules, as well as the machine for producing the same. (Complete specification.)—W. E. Newton. Steam and other engines (com.)—L. Griffiths. Machinery for cleaning tin plates.—E. A. Voile. Machine or apparatus to be employed in the manufacture of Pontefract pipes.

On May 20th.—1784 to 1796.—W. S. Sutherland. Production and application of heat principally for welding or uniting metals, and means or apparatus employed therein.—J. Robertson. Furnaces for heating, reheating, tempering, or otherwise treating iron, steel, or other metals. —J. W. Hoffman. Hand apparatus or travelling type to be used for printing.—S. B. Darwin. Method of lining or coating iron pipes.—W. R. Lake. Dog-collars (com.)—N. Edge and W. Trevor. Looms for weaving.—H. J. Herbert. Means or apparatus to be applied to stoppers, to facilitate the drawing off of liquids from bottles and other vessels (com.)—F. A. Harrison and C. Priestland. Apparatus for adjusting and fixing the cords of window blinds, maps, and other articles.—J. Marshall. Drum protectors and feeding apparatus for thrashing machines.—T. Vicars, sen., T. Vicars, jun., and J. Smith. Steam generators and furnaces.—J. M. B. Baker. Material for the manufacture of horse-shoes, applicable also for other purposes.—E. Iliff and J. Rintoul. Pianoforte action.—A. V. Newton. Rotary engines (com.)

On May 21st.—1797 to 1812.—T. H. P. Dennis. Adaptation of air inlets to stoves, furnaces, water boilers, or heating apparatus of any description, whereby perfect combustion and the economization of fuel is secured.—S. S. Hepworth and G. Paulding. Centrifugal machines. (Complete specification.)—E. P. Alexander. Liquid meters, applicable also as a motive-power engine (com.)—J. A Cicognani. Desilvering lead (com.)—A. G. Henderson and D. Ritchie. Construction of liquid coolers or refrigerators.—E. Belli. Mode of working signals on railways, and apparatus for the same.—J. D. Browne. Power looms.—W. Whiteley. Machinery for roving and spinning fibrous substances. (Complete specification.) — Isaac Bradley. Machinery for heading metallic cartridge cases.—F. H. Oclee and J. Woodcock. Methods of and apparatus for lubricating the slides of steam engines and other machinery, and for filtering the lubricant employed.—P. E. Placet. Engraving.—J. H. Selwyn. Breech-loading fire-arms.—S. H. Smith. Apparatus for marking or scoring in the game of whist and other games of cards, and tables to be employed for such purposes.—W. E. Newton. Process for preparing hydrate of magnesia (com.)—A. G. Hunter. Treating bones, horn-piths, phosphates, and other materials in order to obtain products therefrom, and the apparatus or means employed therefor.—J. Jeyes. Manufacture of waterproof paper or fabrics.

On May 22nd.—1813 to 1821.—J. H. Johnson. Eveners for wool cards (com.)—J. S. Crosland. "Economizers" for heating feed water for boilers by the waste heat passing from the furnace to the chimney.—H. J. Kennard. Sand pumps or apparatus for excavating sand and other material under water.—W. A. Wood. Mowing and reaping machines.—W. R. Trevelyan. Apparatus for securing or locking the barrels of breech-loading fire-arms.—C. Pearson, J. Dean, and T. Cowling. Screw gill boxes for preparing silk, wool, or other fibrous substances for combing.—J. S. Gabriel. Paving roads and ways. —E. O. W. Whitehouse. Producing electric light.—F. Ransome. Manufacture of artificial stone.

On May 23rd.—1822 to 1837.—F. Maigron. Looms for spinning hemp threads, waste silk, also for doubling and twisting wool, cotton, silk, and other filamentous substances. (Complete specification.)—G. F. Bradbury, T. Chadwick, and T. Sugden. Sewing machines.—J. Bell. Distilling coal shale and other substances for the production of oil and gas, and the apparatus employed therein.—D. Macfarlane and R. Macfarlane. Consuming smoke in furnaces or fire grates, and the means or apparatus employed therefor.—R. Goodall. Method of clarifying sewage and impure waters from dye works, bleach works, tanneries, mills, and manufactories, and rendering the precipitate or "sludge" combustible and useful as fuel.—J. Scattergood and B. Wilkes. Manufacture of bolts and spikes, and machinery to be employed in the said manufacture.—G. Knowles, jun. Carding engines.—P. F. Tarbutt. Method of preparing or rendering writing paper available as a means of advertising.—D. Hands and T. Scampton. Manufacture of Scotch caps or bonnets, and the apparatus employed therein, which improvements are also applicable in the manufacture of fabric for other purposes.—H. P. Holt. Metallic connections for attaching neckties and other similar habiliments.—J. Norman. Machines for washing and wringing.—W. Crosland. Bronzing or powdering printed papers or other materials, and the mechanism used therein.—S. Greenwood. Apparatus for the better regulating of steam engines, water mills, and wind mills.—J. B. Booth. Machinery or apparatus for preparing, spinning, doubling, and winding fibrous materials (com.)—A. Martin. Apparatus for saving life and property in case of fire, applicable also for lowering weights for other purposes.—C. S. Clark. Process for the preservation of meat, fish, and other articles of food and similar perishable substances.

On May 25th.—1838 to 1841.—A. G. Hunter. Manufacture of iron and steel and apparatus employed therein.—J. G. Tongue. Indelible ink (com.)—A. Jack. Making of fishing rods and tools for or connected therewith.—E. C. Prentice. Nitric acid.

On May 26th.—1842 to 1847.—R. Harlow. Boilers for hot-water apparatus.—C. D. Abel. Manufacture of steel shovels, spades, scoops, and such like implements (com.)—W. Murdoch. Apparatus for regulating and controlling the action of marine and other engines.—T. G. Dawson and J. Dawson. Printing machinery. (Complete specification).—J. H. Johnson. Manufacture of yeast powder and prepared flour of a self-raising character (com.)—N. W. Wheeler. Art or process of reducing iron and other ores, the production of steel, and apparatus for the practice of the same.

On May 27th.—1848 to 1857.—F. Coles. Food and ice preserving apparatus and ventilator, and portable refrigerator.—H. L Smith. Guiding, driving, and braking vehicles running on single rails.—R. Scott and G. Trueman. Manufacture of lace in twist lace machines.—A. M. Clark. Apparatus for carburetting air and regulating the supply to the burners (com.)—A. T. Adams. Compound winch for raising and lowering carriage (and other) windows.—P. S. Page. Self-locking car couplings (com.) (Complete specification).—S. Ward. Clearers for silk, cotton, and other like materials.—G. Zanni. Submarine and other telegraphic cables.—A. V. Newton. Rudders for screw-propelled vessels (com.)—J. L. Casartelli. Miners' dials or circumferenters.

On May 28th.—1858 to 1872.—J. H. Johnson. Manufacture of iron and steel, and apparatus employed therefor (com.) Complete specification).—T. Staniar. Dressing machines, or apparatus for sifting meal, pollard, and other substances.—J. Leach. Door fasteners for railway wagons.—E. Edwards. Apparatus for separating substances of different specific gravities.—G. O. Gooday. Construction of horse hoes, the same being applicable to drills and cultivators. —S. Ballard and M. Pitts. Warming and ventilating factories, schools, churches, and other public buildings, also private houses or apartments.—A. Heald. Power looms and apparatus connected therewith.—T. H. Marsh. Clamping tools and screw wrenches (com.) —H. Jewitt. New and improved toy (com.) —E. T. Hughes. Manufacture of straw braided fabrics, and machinery therefor (com.)—W. Oram. Machinery for pumping or forcing water, air, or other fluids under pressure.—J. H. Johnson. Umbrellas and parasols (com.)—J. Duncan. Treatment and purification of sugar and saccharine matters, and the apparatus employed therein.—J. Willis. Umbrellas and sunshades.—B. Tower. Apparatus for indicating the velocity or rotation of any revolving spindle.

On May 29th.—1873 to 1886.—H. Nehrlich. Machine for producing cold and motive power. (Complete specification.) — S. de Nomaison. Treating mineral coals by acids.—M. Neuhaus. Constructions or forms of screw bolts and nuts, and appurtenances or appliances connected therewith, and with ordinary bolts and nuts to prevent them working loose from vibration or other causes (partly com.)—E. Hungerford. Medical compounds or liniments.—T. Wheelhouse. Leather-splicing machine.—O. J. Scholz. Machinery for putting capsules on to bottles and other vessels.—J. Hall and W. Hall. Sawing machinery.—W. Everitt. Apparatus for indicating the revolutions of the propeller shafts of steam ships and other shafts or revolving surfaces.—H. J. Barr. Apparatus for indicating the number of revolutions of the paddle wheels or screw propellers of steam vessels, applicable also to denoting the speed of steam engines.—W. Rainforth, sen., and W. Rainforth, jun. Rotary screens for dressing and separating grain. —G. Davies. Construction of hydraulic presses (com.)—J. Higgins and T. S. Whitworth. Machinery or apparatus for preparing cotton and other fibrous materials for spinning.—A. M. Clark. Ebullioscopes (com.)—C. J. Rowsell. Graphoscopes.

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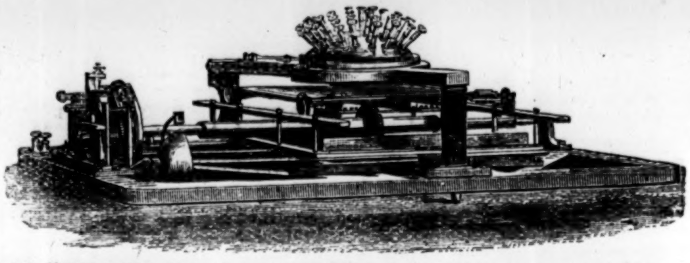

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To furnish advice and professional Assistance in developing Inventions.
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